**Keypad – some calculations**

This keypad needs to be both physical, and virtual (emulated on a tablet). When physical, a “clamshell” design would allow a large keypad, with a large screen that folds over the top when the device is closed.

The emulated version would not be able to do that.

If the keypad and screen form a single unit, dimensions come into play. A screen the same size as the keypad makes the whole device too big. A screen the same width as the keypad, but shorter, ***might*** be the right size – but there’s not enough room on the screen.

The next option is: have a narrower (but taller) screen, with keys underneath ***and*** to one side. This also allows the screen to show custom labels, for the row of keys immediately below the screen.

The overall height of the screen, and the size of the text, now need to be determined. A failure to fix these risks feature “redesign” slowing overall project progress.

**Tablet Dimensions 1: Ipad**

The Ipad screen is 1024 x 768. Assuming 100 pixels wide by 96 high, we can fit up to 7 rows on the screen, leaving 96 pixels. By limiting to 4 rows under the “display” section, we get a display height of 384 pixels.

If the display is equal to the width of six keys, that is a total display area of 600 x 384. By using a font width of 30 pixels, 20 characters per line is possible (The old HP 41C supported 16 chars).

For key labels, assuming labels are no more than 6 chars long, the font needs to be about 15 pixels wide (36 chars total). Assuming three rows of key labels, each row 21 pixels high, the label area is 63 pixels.

With a display of 600 x 321 (384 – 63), and a font 42 pixels high, about **seven lines** of text / numbers can be displayed.

By reducing the height of each key row to 72 pixels, OR reducing to 3 rows of keys, the display increases to 600 x 417 (480 – 63, about **9 lines**). Combining these options gives a display of 600 x 489 (552 – 63, **11 lines**).

**Dot Matrix (extrapolated)**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Width | 5 | 10 | **15** | **30** | **50** |
| Height | 7 | 14 | **21** | **42** | **70** |

**Tablet Dimensions 1: Nexus 7 (2013 Edition)**

The (2013) Nexus 7 screen is 1920W x 1200H. Assuming buttons are 190W x 160H, we can fit 7 rows on the screen, leaving 80 pixels free. Limit to 4 rows under the “display”, get a display height of (80 + 160 + 160 + 160) 560 pixels.

If the display is six keys wide, the total display area is: 1140W x 560H. Using a font 50 pixels wide, 22 characters per line is possible.

For key labels, assuming labels are no more than 6 chars long, the font needs to be about 30 pixels wide (36 chars total). Assuming three rows of key labels (plain, F and G), each row 40 pixels high, the label area is 120H.

With a display of 1140W x 440H (560 – 120), and a font 70 pixels high, about **six** lines of text / numbers can be displayed.

The physical dimensions of the Nexus 7 are: 114mm W x 200mm H x 8.65mm D  
The screen is: 94mm W x 151 mm D

Each button is 190W. Most buttons have 2 labels above (alpha and green menu) , or 2 labels below (F and G functions). Using a font 20W allows 9 characters per label.

**Keycap Size, Spacing and Alignment**

Almost all regular PC keyboards use keycaps of the approximate same size. In this context, I am referring to "size" as the width and depth of each keycap (the *height* of the keycaps we'll examine when we talk about [travel](http://www.pcguide.com/ref/kb/const/cap_Travel.htm).) The size of a regular keycap is approximately 0.5 inches (12.7mm) square on the top of the keycap. The keycap then tapers down to a larger size at its base; a little under 0.75 inches (19mm) square (about 11/16ths of an inch).

*Spacing* of keycaps is also very standardized, at about 0.75 inches from the center of one key to the center of its neighbor on either side. Each row of keys in the main alphanumeric area of the keyboard is also separated by about 0.75 inches of space in a typical keyboard.

The next issue is the *alignment* of the rows of keys in the main part of the keyboard. By this I mean how the keys in one row are offset, left to right, relative to the keys in the row above and below it. Here too there is a standard configuration which is rarely violated. Let's call the bottom row of alphanumeric keys (containing "Z" and "X") row #1. Then the "home row" containing "A" and "S" would be row #2, the row with "Q" and "W" row #3, and the row with the numeric symbols row #4. Alignment is as follows:

* Row #1 is offset from row #2 by about one-half of a key-spacing. That's 3/8ths (0.375) inches (9.525mm).
* Row #2 is offset from row #3 by about one-*quarter* of a key-spacing, or 3/16ths (0.188) inches (4.7625mm). This one's the oddball; I don't know why it isn't 3/8ths like the others, but it isn't. :^)
* Row #3 is offset from row #4 by 3/8ths inches like the offset of row #1 and row #2.

Again, we are discussing the regular alphanumeric keys here; the size, spacing and location of the keys other than the main alphanumerics varies greatly from one keyboard to another. These are discussed in [the description of keyboard layouts](http://www.pcguide.com/ref/kb/layout/index.htm). Also, special keys such as the <Enter> key and <Space Bar> are often of different sizes and spacing can be very different between models.

|  |
| --- |
|  |
| Illustration of a typical keyboard showing the spacing between keys and rows of keys, as well as the offsets between adjacent rows of keys in the main typing area of the keyboard. |

The reason for standardized keycap size, spacing and alignment is a simple one: *not* having a standard would make everyone who has to use more than one keyboard utterly miserable. Touch typists and data entry people learn the "feel" of a keyboard and become used to its spacing and the size of its keys. Moving between two keyboards with different-sized keys or keys with different spacings would slow people down. It would also cause major retraining problems for new employees, or if you bought a new PC, and so on.

There is one place where non-standard keycap size and spacing may sometimes be seen: in very small notebook PCs or PC-like devices. This would be due to the need to conserve space. Fortunately, most notebooks *do* come with keycaps of standard size and spacing, especially now that if anything, notebooks are getting wider due to the desire for larger screens. However, there is also a growing market for very small "sub-notebooks", and here, "shrunken" keycaps are sometimes found. The exact [layout of keys is sometimes a bit strange with notebooks](http://www.pcguide.com/ref/kb/layout/non_Note.htm) but at least *usually* the regular keys are where they should be--without that, anyone working on both a desktop and notebook machine would find life a bit difficult in this regard.

**Keycap Travel**

A very important ergonomic and comfort design factor for keyboards is *keycap travel*. This refers to the distance the keycaps move when the keys are pressed. A keyboard whose keys move down a great deal (relatively speaking) is said to have a "long" travel, while one whose keys move relatively little has a "short" travel. Travel is determined in part by overall keyboard design, but is also a function of the [keyswitch technology](http://www.pcguide.com/ref/kb/const/switch.htm) used.

Travel is an important consideration for touch typists and others who use their keyboards a great deal. Good keyboards, all else being equal, usually have a fairly long travel, about 0.15 inches or more. Less expensive keyboards, or keyboards used in applications where saving space is important, often have travel of less than 0.10 inches (2.54mm). The difference may seem insignificant, but it definitely is not. My regular PC keyboard has a travel of about 0.16 inches (4.06mm); my notebook keyboard is about 0.12 inches (3.05mm). I can use both, but the full-sized keyboard is much more comfortable on my fingers.